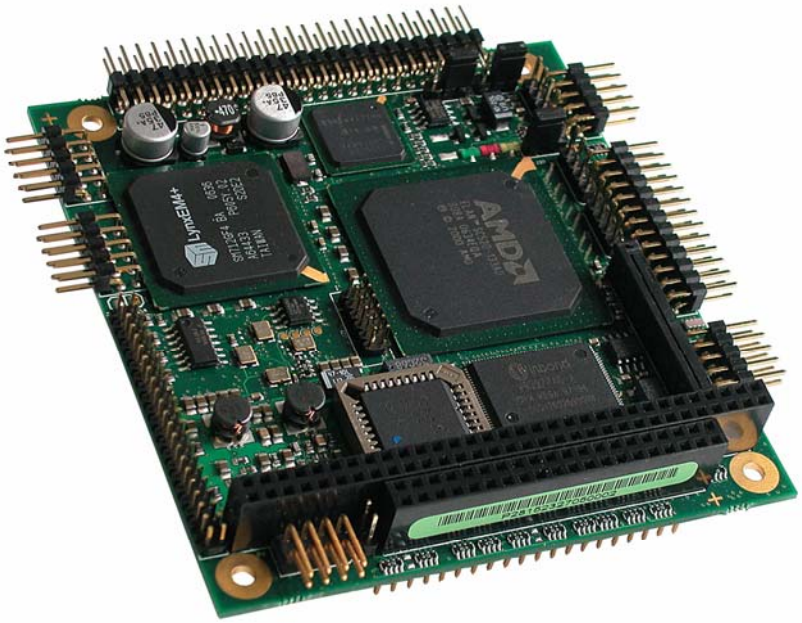
Kontron User's Guide



PC/104-520

Document Revision 1.2

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1. User Information

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Within the warranty period, the repair of products is free of charge as long as warranty conditions are observed.

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1.6 Technical Support

Technicians and engineers from Kontron Embedded Modules GmbH and/or its subsidiaries are available for technical support. We are committed to making our product easy to use and will help you use our products in your systems.

Before contacting Kontron Embedded Modules GmbH technical support, please consult our Website at http://www.kontron-emea.com/emd for the latest product documentation, utilities, and drivers. If the information does not help solve the problem, contact us by telephone or email.

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2. Introduction

2.1 PC/104-520

The PC/104-520 SBC supports the AMD Elan ™SC520 Embedded System Platform. It's a versatile, low-cost, low-power module that conforms to the industry standard 90mm x 96mm PC/104 form factor.

The PC/104-520 features the following:

- Industry-standard Am5$_x$86® CPU with FPU
- System ROM (BIOS)
- Up to 64 MB SDRAM support
- Direct memory access (DMA) controllers
- Counters
- Interrupt controllers
- Keyboard/mouse controllers
- Speaker interface
- Integrated Drive Electronics (IDE) hard-disk interface
- Serial ports (COM1 and COM2)
- Parallel port (LPT1)
- Real-time clock
- Watchdog timer
- Graphic controller with 4 MB on-chip memory
- 10/100Base-TX Ethernet
- ISA bus

2.2 PC/104 an Embedded PC Standard

By standardizing hardware and software around the broadly supported PC architecture, embedded system designers can substantially reduce development costs, risks, and time-to-market.

For these reasons, companies that embed microcomputers as controllers within their products seek ways to reap the benefits of using the PC architecture. However, the standard form factor of a PC bus (12.4" x 4.8") and its associated card cages and backplanes are too bulky and expensive for most embedded control applications.

The only practical way to embed the PC architecture in space and power sensitive applications has been to design a PC chip by chip directly into the product. But this runs counter to growing trend away from "reinventing the wheel." Whenever possible, management encourages outsourcing of components and technologies to reduce development costs and accelerate product design cycles.

A need has arisen for a more compact implementation of the PC bus, satisfying the reduced space and power constraints of embedded control applications. PC/104 was developed in response to this need. It offers full architecture, hardware and software compatibility with the PC bus but in ultra-compact (3.6" x 3.8") stackable modules. PC/104 is ideally suited to the unique requirements of embedded control applications.

Although configuration and application possibilities with PC/104 modules are practically limitless, there are two ways to use them in embedded system designs:

- **Standalone module stacks**
  PC/104 modules are self-stacking. The modules are used like ultra-compact bus boards but do not need backplanes or card cages.
- **Component line applications**
  In this configuration, the modules function as highly integrated components, plugged into custom carrier boards that contain application specific interfaces and logic.

3. Getting Started

The easiest way to get the PC/104-520 board running is to use a starter kit from Kontron Embedded Modules GmbH. Take the following steps:

❶ Connect the power supply to the starter kit baseboard (part of the starter kit).

❷ Plug the PC/104-520 to the PC/104 bus connector on the starter kit baseboard.

❸ Make all necessary connections from the PC/104-520 to the starter kit board.

❹ Connect the CRT monitor to the CRT interface or a LCD panel to the LCD-interface by using the corresponding adapter cable.

❺ Plug a keyboard to the starter kit's keyboard connector.

❻ Plug a hard-drive data cable to the PC/104-520 hard-disk interface. Attach the hard disk to the connector at the opposite end of the cable. If necessary, connect the power supply to the hard disk's power connector.

❼ Make sure all your connections have been made correctly. Turn on the power.

❽ Enter the BIOS by pressing the CTRL+ALT+S keys during boot-up. Make all changes in the BIOS setup. See the BIOS chapter of this manual for details.

4. Specifications

4.1 Functional Specifications

➤ **Processor**

- Industry-standard Am5x86® CPU with FPU
- 100 and 133 MHz operating frequencies

➤ **Internal Bus**

- 33 MHz PCI bus

➤ **Power Supply**

- 5V supply only
- Onboard power supply to low-voltage technology

➤ **Super I/O**

- Winbond W83977HF

➤ **Cache**

- On-die 16kB write-back cache

➤ **Memory**

- Onboard memory up to 64 MB

➤ **Two Serial Ports**

- COM1 and COM2 (RS232C compatible)
- 16550-compatible

➤ **One Parallel Port (LPT1)**

- Bi-directional and Enhanced Parallel Port (EPP) capability

➤ **IDE-Interface (P-ATA)**

- Standard IDE port (up to two devices)

➤ **Ethernet**

- Onboard controller Intel® 82551ER 10/100BASE-T LAN

➤ **Video Graphics Array (VGA)**

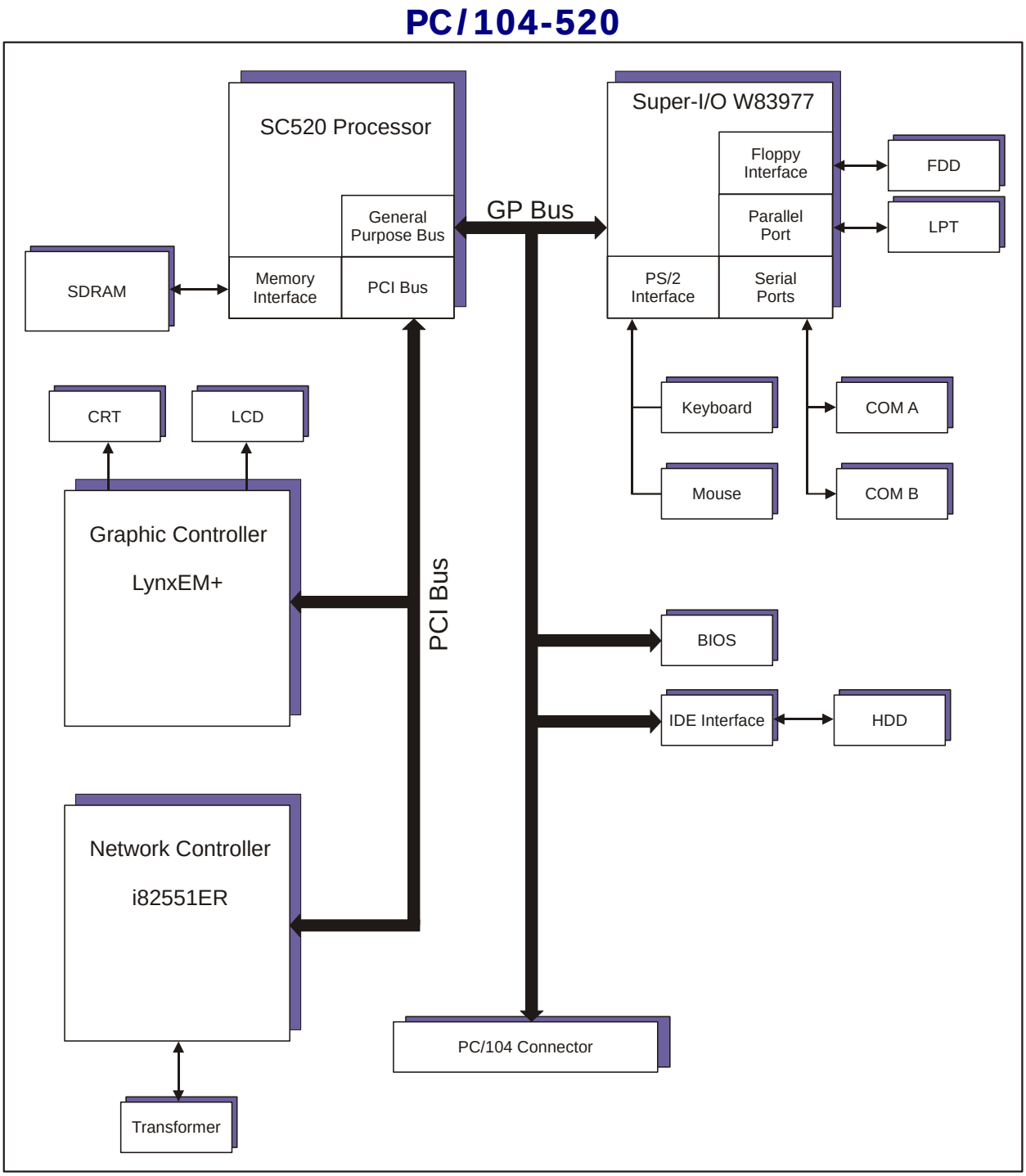
- Onboard controller Silicon Motion SM712 (LynxEM+) with 2D drawing engine, VGA core, LCD backend controller and 135 MHz RAMDAC
- Cathode ray tube (CRT) and LCD flatpanel interface (up to 1024x768 resolution)

➤ **Insyde BIOS, 256kB Flash BIOS**

➤ **Flash BIOS support for CMOS Setup Retention without Battery**

- **PS/2 Keyboard Controller**
- **PS/2 Mouse Controller**
- **Watchdog timer (WDT)**
- **Real-time Clock (requires external battery)**
- **External ISA Bus**
  - Full 8/16 bit Memory and I/O access
  - All ISA IRQ and DMA signals

4.1.1 Block Diagram



4.2 Mechanical Specifications

4.2.1 PC/104 Bus Connector

- One 2x32 pin stackthrough and one 2x20 pin stackthrough connector

4.2.2 Module Dimensions

- 96 x 90mm (3.77” x 3.55”)

4.2.3 Height on Top

- Maximum 11.1mm

4.2.4 Height on Bottom

- Maximum 10.67mm including PC/104 connector

4.3 Electrical Specifications

4.3.1 Supply Voltage

- 5V DC +/- 5 %

4.3.2 Supply Voltage Ripple

- 100 mV peak to peak 0 - 20 MHz

4.3.3 Supply Current (typical)

Power consumption tests were executed during the DOS prompt. The tested boards were equipped with 16 MB SDRAM.

Mode	Normal
Power Consumption 100 MHz	0.9 A
Power Consumption 133 MHz	1.0 A

4.3.4 External RTC Battery

- Voltage range: 2.4V - 3.6V (typ. 3.0V)
- Maximum current: 10µA @ 3.0V

English:
CAUTION ! Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Deutsch:
VORSICHT ! Explosionsgefahr bei unsachgemäßem Austausch der Batterie. Ersatz nur durch den selben oder einen vom Hersteller empfohlenen gleichwertigen Typ. Entsorgung gebrauchter Batterien nach Angaben des Herstellers.

French:
ATTENTION ! Risque d'explosion avec l'échange inadéquat de la batterie. Remplacement seulement par le même ou un type équivalent recommandé par le producteur. L'évacuation des batteries usagées conformément à des indications du fabricant.

Danish:
ADVARSEL ! Lithiumbatteri – Eksplosionsfare ved fejlagtig Håndtering. Udskifting må kun ske med batteri af samme fabrikant og type. Lever det brugte batteri tilbage til leverand∅ren.

Finnish:
VAROITUS ! Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan laltevalmistajan suosittelmaan tyyppiln. Havita kaytetty paristo valmistajan ohjeiden mukaisesti.

Spanish:
Precaución ! Peligro de explosión si la batería se sustituye incorrectamente. Sustituya solamente por el mismo o tipo equivalente recomendado por el fabricante. Disponga las baterías usadas según las instrucciones del fabricante.

The battery of this product is not considered to be accessible by the end user. Therefore the safety instructions are only given in english, german, french, danish, finish and spanish language.

If the battery of this product however is accessible by the end user, it is in the responsibility of the customer to give the corresponding safety instructions in the required language(s).

4.4 Environmental Specifications

4.4.1 Temperature

The AMD SC520 is specified for proper operation when case temperature is within the specified range of +5°C to +85°C.

- Operating: +5° to +55°C *(1)*
- Non operating: -10° to +80°C

Note: *1 The maximum operating temperature is the maximum measurable temperature on any spot on a module's surface. You must maintain the temperature according to the above specification.*

4.4.2 Humidity

- Operating: 10% to 90% (non condensing)
- Non operating: 5% to 95% (non condensing)

4.5 MTBF

The following MTBF (Mean Time Between Failure) values were calculated using a combination of manufacturer's test data, if the data was available, and a Bellcore calculation for the remaining parts. The Bellcore calculation used is "Method 1 Case 1". In that particular method the components are assumed to be operating at a 50% stress level in a 40°C ambient environment and the system is assumed to have not been burned in. Manufacturer's data has been used wherever possible. The manufacturer's data, when used, is specified at 50°C, so in that sense the following results are slightly conservative. The MTBF values shown below are for a 40°C in an office or telecommunications environment. Higher temperatures and other environmental stresses (extreme altitude, vibration, salt water exposure, etc.) lower MTBF values.

- System MTBF (hours) : tbd

Note: *Fans usually shipped with Kontron Embedded Modules GmbH products have 50,000-hour typical operating life. The above estimates assume no fan, but a passive heat sinking arrangement. Estimated RTC battery life (as opposed to battery failures) is not accounted for in the above figures and need to be considered for separately. Battery life depends on both temperature and operating conditions. When the Kontron unit has external power; the only battery drain is from leakage paths.*

5. CPU, Chipset and Super I/O

5.1 CPU

The central processing unit (CPU) is part of the AMD SC520 Microcontroller with following features

- Industry-standard Am5x86® CPU with FPU, 100 and 133 MHz operating frequencies
- High performance, low-power core
- On-die 16 kByte write-back cache

5.2 SC520 Microcontroller

- 32 bit 3.3V PCI bus (5V tolerant) Rev. 2.2 compliant
- Integrated SDRAM controller supports 16-, 64-, 128- and 256-MBit RAM up to 64 MBytes
- General Purpose (GP) bus with programmable timing for 8 and 16 Bit devices
- On-Chip Flash controller
- Standard PC/AT compatible peripherals as Timer, IRQ and DMA controller
- Integrated watchdog function

5.3 Super I/O

The external Super I/O WINBOND W83977F offers the following features:

- Integrated keyboard controller with PS/2 mouse support
- Two serial ports and one multi-mode parallel port
- Floppy disk controller

6. ISA Bus Expansion

The design of the PC/104-520 follows the standard PC/104 form factor and offers ISA bus signals for the use of standard PC/104 adapter cards.

6.1 PC/104 Bus (ISA part)

The PC/104 bus consists of two connectors that use 104 pins in total.

- XT bus connector (64 pins)
- AT bus connector (40 pins, which is optional for 16 bit data bus system)

The pinout of the PC/104 bus connectors corresponds to the pinout of the ISA bus connectors with some added ground pins. The two PC systems with different form factors are electrically compatible.

The **XT bus connector**, Row A and B.

The corresponding 64-pin stackthrough header (ISA bus = 62pins) has two added ground pins at the end of the connector (Pin A32 and Pin B32). The pinout between PC/104 bus and XT ISA bus is identical between A1 - A31 and B1 - B31.

The **AT bus extension connector**, Row C and D.

The corresponding 40-pin stackthrough header (ISA bus = 36 pins) has four added ground pins, two on each side of the connector. To avoid confusion, the first two pins are defined as Pin C0 and Pin D0. The additional ground pins at the end of the connector are defined as C19 and D19. The pinout between PC/104 bus and AT ISA bus is identical between C1 - C18 and D1 - D18.

6.1.1 PC/104 Connectors

The PC/104-520 features both – XT bus and AT bus extension – on two, dual-row socket connector with 2.54mm x 2.54mm grid (0.1" x 0.1").

The PC/104 XT bus is available through the X4B connector. The PC/104 AT bus is available through the X4C connector.

A detailed description of the signals including electrical characteristics and timings is beyond the scope of this document. Please refer to the official ISA bus and PC/104 specifications for more details.

6.1.2 PC/104 Configuration

When using add-on boards on the PC/104 bus, make sure that there are no resource conflicts in the system. Carefully choose hardware interrupts, DMA channels, memory and I/O address ranges to avoid resource conflicts, which are often the reason for a board or a feature not functioning correctly.

PC/104 adapter cards are mounted in a stack-through manner. Adapter cards are designed with plugs on their undersides that mate with the PC/104 socket connectors of PC/104-520. PC/104 adapters can support the socket connector version on their topside and allow additional stacking of adapters.

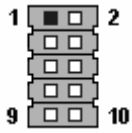
Whenever possible use the PC/104-520 as top module of the PC/104 stack as the CPU board is normally the board with the highest heat dissipation.

7. Graphics Interface

The graphics controller supports CRT monitors and a variety of LCD panels with single or double clock, color depths of 18/24 bit and resolutions up to XGA (1024x768).

7.1 CRT Connector

The CRT monitor interface is available through the J4 connector (10 pins). To have the signals available on a standard DSUB-15 CRT monitor connector, an adapter cable is required. A 15-pin DSUB cable is available from Kontron (KAB-PC104520-VGA, Part Number 96229-0200-00-0).

Header	Pin	Signal Name	Function	DSUB-15
	1	GND	Signal ground	7
	2	GND	Signal ground	*
	3	GND	Signal ground	*
	4	GND	Signal ground	*
	5	RED	Analog video red	1
	6	HSYNC	Horizontal sync	13
	7	GREEN	Analog video green	2
	8	VSYNC	Vertical sync	14
	9	BLUE	Analog video blue	3
	10	NC	Not connected	--

To find the location of the CRT connector on the PC/104-520 board, please see the Appendix “Connector Layout”.

7.2 LCD Panel Connector

The interface for the LCD Panel is available through the J3 connector (50 pins) on the top side of the board. Detailed information about available panel cables on request.

When using a LCD Panel, additional voltages may be required to drive the display’s logic and to supply the backlight converter. The display logic may require +5V for standard or +3.3V for low-power LCDs. The on-board 3.3V-circuitry of the PC/104-520 and the +3.3V logic voltage of low-voltage panels are share the same voltage regulators.

To find the location of the LCD Panel interface connector on the PC/104-520 board, please see the Appendix “Connector Layout”.

Note: *You need to supply the +12V for the backlight converter additionally when using such a converter type.*

7.3 Connecting a LCD Panel

To determine whether your panel display is supported, check the Kontron Website for panel lists. We regularly update the list of panels that have been tested with the PC/104-520.

If you use one of those cables supplied by Kontron, configuration is easy:

❶ Check whether you have the correct cable for the panel you plan to use. Inspect the cable for damages. Disconnect the power from your system.

❷ Check Jumper J16 for correct Panel voltage (J16 1-2 = 5V 2-3 = 3.3V). Hint: J16 1-2 default.

❸ Check Jumper J17 for inverting data clock (J17 1-2 = normal 2-3 = inverted). Hint: J17 1-2 default.

❹ Connect the cable to the LCD Panel connector J3 on the PC/104-520 and connect the other end to your display.

❺ Connect the backlight converter.

❻ Supply power to your system.

❼ If no image appears on your display, connect a CRT monitor to the CRT connector.

❽ If you still do not see improvement, consider contacting the dealer for technical support.

7.4 Available Video Modes

The following list shows the video modes supported by the graphics controller with maximum frame buffer size. Capability depends on system configuration and on display capabilities. Different operating systems also may not support all listed modes by the available drivers.

7.4.1 Standard IBM-Compatible VGA Modes

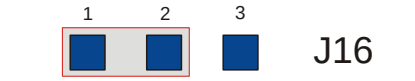
Video Mode	Type	Characters/Pixels	Colors
00h/01h	Text	40x25	16
02h/03h	Text	80x25	16
04h/05h	Graphics	320x200	4
06h	Graphics	640x200	2
07h	Text	80x25	2
0Dh	Graphics	320x200	16
0Eh	Graphics	640x200	16
0Fh	Graphics	640x350	2
10h	Graphics	640x350	16
11h	Graphics	640x480	2
12h	Graphics	640x480	16
13h	Graphics	320x200	256

7.4.2 Extended VESA VGA Modes

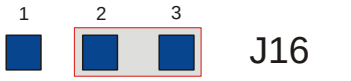
VESA Mode	Type	Pixels	Colors
101h	Graphics	640x480	256
102h	Graphics	800x600	16
103h	Graphics	800x600	256
104h	Graphics	1024x768	16
105h	Graphics	1024x768	256
111h	Graphics	640x480	64K
112h	Graphics	640x480	16M
114h	Graphics	800x600	64K
115h	Graphics	800x600	16M
117h	Graphics	1024x768	64K

7.4.3 Panel Configuration

J16 defines two panel power supplies: +5V and +3.3V.

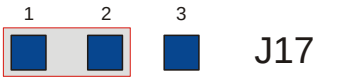


Panel Vcc = +5V

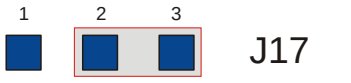


Panel Vcc = +3.3V

J17 makes it possible to invert the clock signal.



Normal Clock



Inverted Clock

The following table shows the panel signal assignment.

J3 Pin	Pin Name	Mono DD	Color STN DD	Color TFT 18/24 Bit	Color TFT 2x12 Bit
17	FP0		LD0	B0	BA0
19	FP1	LD0	LD1	B1	BA1
26	FP2		LD2	B2	BA2
28	FP3		LD3	B3	BA3
30	FP4	LD1	LD4	B4	BB0
32	FP5		LD5	B5	BB1
13	FP6		LD6	B6	BB2
15	FP7	LD2	LD7	B7	BB3
38	FP8			G0	GA0
40	FP9			G1	GA1
42	FP10	LD3		G2	GA2
44	FP11			G3	GA3
46	FP12		UD0	G4	GB0
48	FP13	UD0	UD1	G5	GB1
34	FP14		UD2	G6	GB2
36	FP15		UD3	G7	GB3
47	FP16	UD1	UD4	R0	RA0
45	FP17		UD5	R1	RA1
43	FP18		UD6	R2	RA2
14	FP19	UD2	UD7	R3	RA3
16	FP20			R4	RB0
18	FP21			R5	RB1
50	FP22	UD3		R6	RB2
49	FP23			R7	RB3
9	CLK	CLK	CLK	CLK	CLK
5	LP/HSYNC	LP	LP	HSYNC	HSYNC
3	FLM/VSYNC	FLM	FLM	VSYNC	VSYNC
1, 7	DE	DE	DE	DE	DE

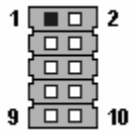
8. Serial-Port Interfaces

Two fully functional serial ports (COMA and COMB) provide asynchronous serial communications. COMA and COMB support RS-232 operation modes. They are 16550 high-speed UART compatible and support 16-byte FIFO buffers for transfer rates from 50 Baud to 115.2 KBaud.

8.1 Connector

COMA is available through the J1 connector (10 pins) and COMB through the J2 connector (10 pins). To have the signals available on the standard serial interface connectors DSUB-9 or DSUB-25, an adapter cable is required.

A 9-pin DSUB cable is available from Kontron (KAB-DSUB9-2, Part Number 96017-0000-00-0). The following table shows the pinouts for COMA and COMB, as well as necessary connections for DSUB adapters.

Header	Pin	Signal Name	Function	In/Out	DSUB-25	DSUB-9
	1	/DCD	Data Carrier Detect	In	8	1
	2	/DSR	Data Set Ready	In	6	6
	3	RxD	Receive Data	In	3	2
	4	/RTS	Request to Send	Out	4	7
	5	TxD	Transmit Data	Out	2	3
	6	/CTS	Clear to Send	In	5	8
	7	/DTR	Data Terminal Ready	Out	20	4
	8	/RI	Ring Indicator	In	22	9
	9	GND	Signal Ground	--	7	5
	10	VCC *(1)*	+5V	--	--	--

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

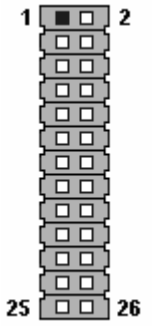
To find the location of the serial ports on the PC/104-520 board, please see the Appendix “Connector Layout”.

9. Parallel-Port Interface

The PC/104-520 incorporates a parallel port that can be set to uni-/bidirectional and Enhanced Parallel Port (EPP) modes.

9.1 Connector

The parallel port is available through the J8 connector (26 pins). To have the signals available on a standard, parallel interface connector DSUB-25, an adapter cable is required, which is offered by Kontron (KAB-DSUB25-1, Part Number 96015-0000-00-0). The following table shows the pinout as well as necessary connections for a DSUB-25 adapter.

Header	Pin	Signal Name	Function	In / Out	DSUB-25
	1	/STB	Strobe	Out	1
	3	PD0	Data 0	I/O	2
	5	PD1	Data 1	I/O	3
	7	PD2	Data 2	I/O	4
	9	PD3	Data 3	I/O	5
	11	PD4	Data 4	I/O	6
	13	PD5	Data 5	I/O	7
	15	PD6	Data 6	I/O	8
	17	PD7	Data 7	I/O	9
	19	/ACK	Acknowledge	In	10
	21	/BUSY	Busy	In	11
	23	PE	Paper out	In	12
	25	/SLCT	Select out	In	13
	2	/AFD	Autofeed	Out	14
	4	/ERR	Error	In	15
	6	/INIT	Init	Out	16
	8	/SLIN	Select in	Out	17
	26	NC	Not connected	--	--
	10,12	GND	Signal Ground	--	18 - 25
	14,16	GND	Signal Ground	--	18 - 25
	18,20	GND	Signal Ground	--	18 - 25
	22,24	GND	Signal Ground	--	18 - 25

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

To find the location of the parallel port on the PC/104-520 board, please see the Appendix “Connector Layout”.

10. Keyboard Interface

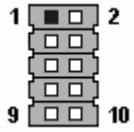
The keyboard and feature connector of the PC/104-520 offers four functions. The interface connects the following:

- Keyboard
- Speaker
- Battery
- Reset Button

10.1 Connector

The keyboard and feature connector is available through Connector J9 (10 pins). An adapter cable is required to connect a standard keyboard to this interface. There are two adapter cables available from Kontron. One can be used for AT-keyboard (KAB-KB-1, Part Number 96023-0000-00-0), the other for PS/2-keyboard (KAB-KB-PS2, Part Number 96060-0000-00-0), but these cables don't support the other functions of this connector.

The following table shows the pinout as well as necessary connections for adapters.

Header	Pin	Signal Name	Function	5 pin DIN (Diode)	6 pin MiniDIN (PS/2)
	1	Speaker	Speaker output		
	2	GND	Ground		
	3	/RESIN	Reset input		
	4	/KBLOCK	Keyboard lock		
	5	KBDAT	Keyboard data	2	1
	6	KBCLK	Keyboard clock	1	5
	7	GND	Ground	4	3
	8	VCC *(1)*	+5V	5	4
	9	BATT *(2)*	Battery in (3,0V)		
	10	/RESIN	Reset input		

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.
2 Pin 9 and pin 3 (power connector) are not decoupled. Do not connect two batteries.

To find the location of the keyboard and feature connector on the PC/104-520 board, please see the Appendix “Connector Layout”.

10.2 Signal Descriptions

/RESIN

- Input on CPU modules

Speaker

- Open collector output on modules that drive a piezo electronic speaker
- Input on modules that connects a 5V piezo electronic speaker to this pin
- An 8 Ohm loudspeaker also can be connected between SPEAKER and GND, but because of current limitation the volume will be low
- Connect only one speaker to this pin. The CPU usually drives this pin. However, other modules also can use this signal to drive the system speaker

KBDAT (Keyboard Data)

- Bidirectional I/O pin on CPU modules
- Keyboard data signal

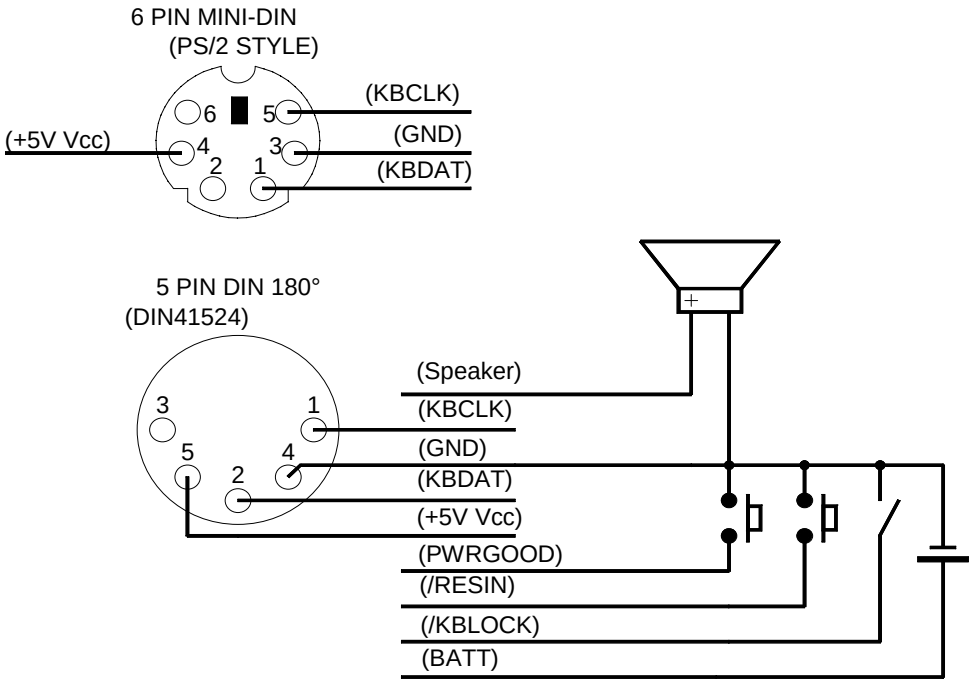
KBCLK (Keyboard Clock)

- Bidirectional I/O pin on CPU modules
- Keyboard clock signal

BATT (System Battery Connection)

- This pin connects a system battery to all modules
- The battery voltage has to be higher than 2.4V and lower than 3.6V. A 3V battery is recommended
- A battery is not needed to hold CMOS setup data. Your configurations for hard disks, floppy drives, and other peripherals are saved in an onboard EEPROM. However, you need a battery to save the CMOS date and time when power supply is turned off

10.2.1 Example Connection AT-keyboard and Other Functions



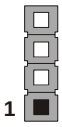
11. PS/2-Mouse Interface

The Super I/O of the PC/104-520 supports a PS/2 mouse.

11.1 Connector

The PS/2 mouse interface is available on Connector J10 (4pins). An adapter cable is required to connect a standard PS/2 mouse. It is available from Kontron (KAB-PC104520-MOUSE-PS2, Part Number 96230-0200-00-0).

The following table shows the pinout and connections for a PS/2 mouse adapter.

Header	Pin	Signal Name	Function	6 pin MiniDIN PS/2
	1	MSDAT	Mouse data	1
	2	VCC *(1)*	+5V	4
	3	GND	Ground	3
	4	MSCLK	Mouse clock	5

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

To find the location of the PS/2 mouse connector on the PC/104-520 board, please see the Appendix “Connector Layout”.

12. IDE Interface

The PC/104-520 features one IDE interface that can drive two hard disks. When two devices share a single adapter, they are connected in a master/slave, daisy-chain configuration. If only one drive is in the system, you must set it as the master.

12.1 Connector

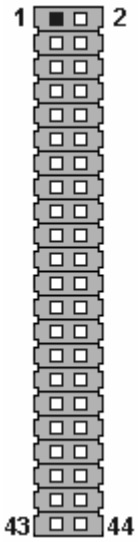
The IDE interface is available through Connector J13 (44 pins). This interface is designed in 2mm grid for optimal connectivity to a 2.5" hard disk.

There are several accessories available for IDE connectivity.

You can use two cables to directly connect a hard disk in a 2.5" form factor (KAB-IDE-2MM, Part Number 96021-0000-00-0) or a 3.5" form factor (KAB-IDE-25, Part Number 96020-0000-00-0).

You can plug a Kontron chipDISK, which is an IDE hard disk that uses Flash technology, into the IDE interface and mechanically mount it by using a mini-spacer on the chipDISK hole. You also can use a chip-DISK adapter (chipDISK-ADA1, Part Number 96004-0000-00-0) or compact Flash adapter (CFC-ADA1, Part Number 96004-0000-00-2) for more disk support.

The following table shows the pinout.

Header	Pin	Signal Name	Function	Pin	Signal Name	Function
	1	/RESET	Reset	2	GND	Ground
	3	HDD7	Data 7	4	HDD8	Data 8
	5	HDD6	Data 6	6	HDD9	Data 9
	7	HDD5	Data 5	8	HDD10	Data 10
	9	HDD4	Data 4	10	HDD11	Data 11
	11	HDD3	Data 3	12	HDD12	Data 12
	13	HDD2	Data 2	14	HDD13	Data 13
	15	HDD1	Data 1	16	HDD14	Data 14
	17	HDD0	Data 0	18	HDD15	Data 15
	19	GND	Ground	20	Key (NC)	Key pin
	21	DRQ	IDE DMA Request	22	GND	Ground
	23	/IOW	I/O write	24	GND	Ground
	25	/IOR	I/O read	26	GND	Ground
	27	IOCHRDY	I/O channel ready	28	CSEL *(2)*	Cable Select
	29	/ACK	Acknowledge	30	GND	Ground
	31	IRQ	Interrupt	32	/IOCS16	16 Bit transfer
	33	SA1	Addr 1	34	NC	Not connected
	35	SA0	Addr 0	36	SA2	Addr 2
	37	/CS0	Chip select 0	38	/CS1	Chip select 1
	39	/DASP	Drive active / Slave	40	GND	Ground
	41	VCC *(1)*	+5V	42	VCC Motor *(1)*	+5V
	43	GND	Ground	44	NC	Not connected

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.
2 Pin 28 is connected with 470Ω to Ground for Cable Select IDE devices.

To find the location of IDE interface on the PC/104-520 board, please see the Appendix “Connector Layout”.

13. Ethernet Controller

The PC/104-520 uses a Intel 82551ER PCI Fast Ethernet Controller. The network controllers support 10/100 Base-T interfaces. The devices auto-negotiate the use of a 10 Mbit/sec or 100 Mbit/sec connection.

13.1 Connector

The Ethernet interface is available through Connector J7 (4 pins). To have the signals of the Ethernet connection available on a standard RJ45 connector, you need an adapter cable, which is offered by Kontron (KAB-PC104520-ETN, Part Number 96231-0200-00-0).

The following table shows the pinout.

Header	Pin	Signal Name	Function	In/Out
	1	TXD+	Transmitter	Differential Output
	2	TXD-	Transmitter	Differential Output
	3	RXD+	Receiver	Differential Input
	4	RXD-	Receiver	Differential Input

Note: *TXD+, TXD- differential-output pair drives 10 and 100 Mb/s Manchester-encoded data to 100/10 BASE-T transmit lines. RXD+, RXD- differential input pair receives 10 and 100 Mb/s Manchester-encoded data from 100/10BASE-T receive lines.*

To find the location of the Ethernet interface on the PC/104-520 board, please see the Appendix “Connector Layout”.

14. Floppy-Drive Interface

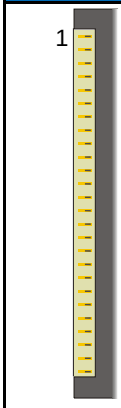
The floppy-drive interface of the PC/104-520 uses a 2.88 MB super I/O floppy-disk controller and can support one floppy disk drive with densities that range from 360 kB to 2.88 MB. The controller is 100% IBM compatible.

14.1 Connector

The floppy disk interface is available on the flat-foil connector J11 (26 pins). This type of connector is often internally used in notebooks to connect a slim-line floppy drive.

Accessories are available for this interface from Kontron. To connect a standard 3.5" floppy drive, use an adapter cable (ADA-FLOPPY-2, Part Number 96001-0000-00-0). If you have a slim-line 3.5" floppy drive, you may need a flat foil cable (KAB-FLOPPY/ MOPS-1, Part Number 96019-0000-00-0). It also is possible to get a slim line 3.5" floppy drive with cable from Kontron (FLOPPY-MOPS-1, Part Number 96010-0000-00-0).

The following table shows the connector pinout.

Header	Pin	Signal Name	Function	Pin	Signal Name	Function
	1	VCC *(1)*	+5V	2	/IDX	Index
	3	VCC *(1)*	+5V	4	/DR0	Drive Select 0
	5	VCC *(1)*	+5V	6	/DSKCHG	Disk Change
	7	VCC *(1)*	+5V	8	NC	Not connected
	9	NC	Not connected	10	/MTR0	Motor on 0
	11	NC	Not connected	12	/FDIR	Direction Select
	13	NC	Not connected	14	/STEP	Step
	15	GND	Ground	16	/WDATA	Write Data
	17	GND	Ground	18	/WGATE	Write Gate
	19	GND	Ground	20	/TRK0	Track 00
	21	GND	Ground	22	/WRTPRT	Write Protect
	23	GND	Ground	24	/RDATA	Read Data
	25	GND	Ground	26	/HDSEL	Side One Select

Note: *1 To protect the external power lines of peripheral devices, make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

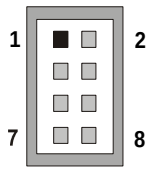
To find the location of floppy-drive interface on the PC/104-520 board, please see the Appendix "Connector Layout".

15. Power Connector

In some applications, the PC/104-520 is intended for use as a stand-alone module without a backplane. You need to have a power connector available on the board for direct power supply. The PC/104-520 is a +5V only board. Peripherals can obtain additional voltage from the power connector next to the PC/104 bus. The additional voltages (+12V, -5V and -12V) are not generated onboard the PC/104-520.

15.1 Connector

The pinout of the power connector P6 (8 pins) is shown in the table below.

Header	Pin	Signal Name	Function
	1	GND	Ground
	2	VCC	+5V
	3	BATT	Battery
	4	+12V	+12V
	5	NC	Not connected
	6	-12V	-12V
	7	GND	Ground
	8	VCC	+5V

To find the location of the power connector on the PC/104-520 board, please see the Appendix “Connector Layout”.

15.2 Power Pins

Every power pin on the power connector as well as on the PC/104 bus connector is limited to a maximum current of 1A per pin.

If a system using a PC/104-520 is only supplied from the power connector, the following limitations apply:

Power	Number of Pins	Max. Current
VCC (+5V)	2	2A
+12V	1	1A
-12V	1	1A
GND	2	2A

A system using the PC/104-520 also can be supplied from the PC/104 bus connectors. If only those supply voltages pins are used, the following limitations apply:

Power	Number of Pins on ISA Part	Max. Current
VCC (+5V)	4	4A
+12V	2	2A
-12V	2	2A
GND	8	8A

Modules on the PC/104 bus consuming a higher supply current must provide power supply through an additional connector.

Note: *The PC/104-520 is not a replacement for a backplane. Use all power pins on the power connector and on the PC/104 connectors for power supply to the PC/104-520, and also use all additional power connectors on additional I/O cards if your system exceeds the above limitations. It is not acceptable to use only the power pins of the PC/104 connector for power supply to the full PC/104 stack.*

15.3 External Battery

You can connect an external battery to Pin 3 (BATT) of the power connector instead of Pin 9 of the KBD connector. For more information refer to the Keyboard chapter of this manual.

Note: *Pin 3 (power connector) and Pin 9 (KBD connector) are connected to the same signal. The pins are not decoupled, therefore do not connect two batteries.*

When CMOS memory (containing your system's configuration) is erased, the CPU is reset to the delivery default. Hint: the flash memory (including a copy of the CMOS memory) is not affected by this operation.

16. Watchdog Timer

The watchdog timer (WDT) is integrated in the Winbond W83977F controller of the PC/104-520 and can issue a reset to the system. The watchdog timer circuit has to be triggered within a specified time by the application software. If the watchdog timer is not triggered because proper software execution fails or a hardware malfunction occurs, it resets the system.

16.1 Programming

16.1.1 Initialization

You can initialize the watchdog timer from the application software (sourcecode on request) or BIOS setup. Setup option uses a fixed timeout period of 32 seconds.

Likewise a JIDA call (INT 15h) is available. Register values:

AX = 0E000h
BX = 0h ⇨ Watchdog off / BX = 1h ⇨ timeout 1 sec. / BX = 2h ⇨ 2 sec. / BX = 3h ⇨ 4 sec.
BX = 4h ⇨ 8 sec. / BX = 5h ⇨ 16 sec. / BX = 6h ⇨ 32 sec.
CX = 0h
DX = 0h

16.1.2 Trigger

The watchdog needs to be triggered out of the application software within a specified timeout period. You can only do this in the application software by using low-level programming.

Likewise a JIDA call (INT 15h) is available. Register values:

AX = 0E001h
BX = CX = DX = 0h

16.1.3 Utility SC520Wdt

SC520Wdt is a program to activate, deactivate and trigger the watchdog. Syntax:

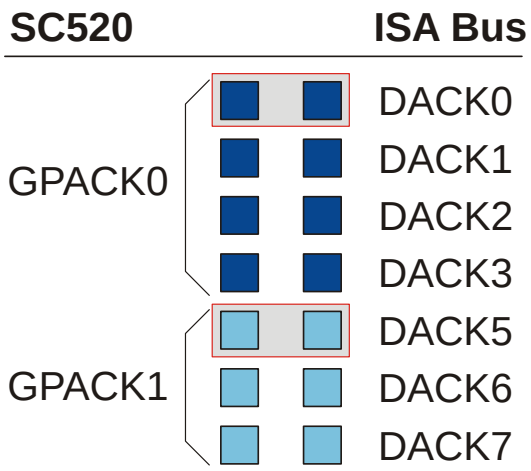
SC520Wdt [options]

/A	Enable Watchdog
/D	Disable Watchdog
/R	Trigger Watchdog

17. DMA Configuration

17.1 DMA Acknowledge

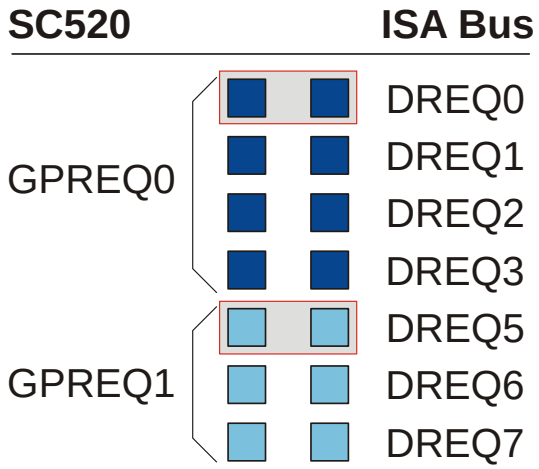
To select one out of eight DACK lines following jumpers are available as JP1. For the SC520 GPACK0 line use DACK0, DACK1, DACK2 or DACK3, for SC520 GPACK1 line use DACK5, DACK6 or DACK7. Place only one jumper for each GPACK0 and GPACK1 line. Please select this configuration also in the BIOS setup. The delivery default is framed.



Note: *In addition to JP1 there is the possibility to connect DACK3 to GPACK1 instead of DACK5-7. Use* ***R90*** *for this purpose. Please select the configuration also in the BIOS setup.*

17.2 DMA Request

To select one out of eight DREQ lines following jumpers are available as JP2. For the SC520 GPREQ0 line use DREQ0, DREQ1, DREQ2 or DREQ3, for SC520 GPREQ1 line use DREQ5, DREQ6 or DREQ7. Place only one jumper for each GPREQ0 and GPREQ1 line. Please select this configuration also in the BIOS setup. The delivery default is framed.



Note: *In addition to JP2 there is the possibility to connect DREQ3 to GPREQ1 instead of DREQ5-7. Use* ***R91*** *for this purpose. Please select the configuration also in the BIOS setup.*

18. Onboard Device Configuration

Many of the onboard devices offer several configuration settings in the System BIOS setup. Refer to chapter SETUP GUIDE for more configuration information.

Onboard Device	see Main Menu / Sub Menu
Graphics Interface	Video / Video out Mode Video / Flatpanel Type Video / Adjust BIAS Voltage PCI-ISA / Configure PCI VGA
CPU/Memory Interface	Components / CPU Speed Memory / Cache Systems
Serial Port Interfaces	Components / COM Ports
Parallel Port Interface	Components / LPT Port Components / LPT Type
Keyboard Interface	Components / Keyboard Numlock Components / Keyboard Repeat
PS/2 Mouse Interface	Components / Enable PS2-Mouse
Network Interface	PCI-ISA / Configure PCI Ethernet
IDE Interface	Disks / Virus Alert Disks / Hard Disk 1 Disks / Hard Disk 2 Disks / Swap HDD 1 and 2 Disks / Detect ATAPI Drive Startup / Boot Device
Floppy Interface	Disks / Diskette Drives Startup / Boot Device
Watchdog Timer	Startup / Enable Watchdog
External ISA Slots	PCI-ISA / Configure DMA Channels PCI-ISA / Configure ISA Timing
BIOS Extensions (Miscellaneous)	Startup / Dark Boot Startup / Fast Boot Startup / Show '<CTRL-ALT-S> ..' Startup / Wait for F1 on Error Startup / Remote Control Startup / Setup Password Components / Enable Standard PIT

19. Setup Guide

The INSYDE BIOS Setup Utility changes system behavior by modifying the BIOS configuration. The setup program uses a number of menus to make changes and turn features on or off.

Whenever you contact technical support about BIOS issues, providing a BIOS version <PC/104 520 Version ?.??> is especially helpful.

19.1 Start INSYDE BIOS Setup Utility

To start the INSYDE BIOS Setup Utility, press the <**CTRL+ALT+S**> keys when the following string appears during boot up.

```
Press <CTRL-ALT-S> to enter SETUP
```

The Main Menu then appears.

19.2 General Information

The **Setup Screen** is composed of several sections:

Setup Screen	Location	Function
Menu Bar	Top	Lists and selects all top-level menus
Item Specific Help Window	Bottom	Help for selected item

Menu Bar

The menu bar at the top of the window lists different menus. Use the <**Alt**> key to enter the menu and the <**Left/Right/Up/Down Arrow**> keys to make a selection. For submenus use the <**Enter**> and <**Tab**> keys to choose an entry and the <**Space**> key to accept the selection.

Enabled / Disabled Functionality

Enabled is represented by a '✔' and **Disabled** by a ' ▁ '.

Note: *In the Option column,* ***bold*** *shows default settings.*

19.3 Startup Menu

Feature	Option	Description
▸ Date and Time	N/A	Sets system date and time
Dark Boot	**Disabled** Enabled	If enabled, system comes up with a blank screen instead of the diagnostic screen during boot-up
Fast Boot	Disabled **Enabled**	Allows the system to skip certain tests while booting. This decreases the time needed to boot the system
Show '<CTRL-ALT-S> ..'	Disabled **Enabled**	If enabled, a delay gives a real chance to enter the BIOS setup
Wait for F1 on Error	**Disabled** Enabled	Determines if post errors cause the system to halt
▸ Boot Device	**Diskette A:** Hard Disk C:	Defines the boot device
Enable Watchdog	**Disabled** Enabled	Enables or disables the internal watch-dog. The timeout period is 32 seconds
▸ Remote Control	**COM1** COM2 LPT1	Sets the onboard remote port to commu-nicate with the remote server
▸ Setup Password	N/A	Pressing <Enter> displays the dialog box for entering the setup password. In rela-ted systems, the setup password gives restricted access to the setup entries

19.4 Video Menu

Feature	Option	Description
▸ Video out Mode	CRT Flatpanel **Simultan**	Selects display boot devices
▸ Flatpanel Type	**00: 640x480 DD Mono 8Bit** 02: 640x480 STN 16Bit 05: 640x480 TFT 18Bit 06: 1024x768 TFT 2x12Bit 07: 800x600 TFT 18Bit	Defines the LCD panel resolution and color depth
▸ Adjust BIAS Voltage	**16.2V**, 16.4V, 16.6V, 16.9V 17.2V, ..., 29.3V, 30.1V, 31.1V	Sets the contrast voltage for STN LCD pa-nels

19.5 Memory Menu

Feature	Option	Description
▸ Cache Systems	Disabled **Write Back**	Defines the mode of L1 cache

19.6 Disks Menu

Feature	Option	Description
▸ Diskette Drives	None, 360 KB 720 KB, 1.2 MB **1.44 MB**, 2.88 MB	Sets type of floppy disk drive
Virus Alert	**Disabled** Enabled	Enables or disables the virus warning for IDE hard-disk boot sector
▸ Hard Disk 1 ▸ Hard Disk 2	Submenu	Defines the harddisk parameter
Swap HDD 1 and 2	**Disabled** Enabled	Swaps both harddisk drives and enable you to boot from the second harddisk
Detect ATAPI Drive	**Disabled** Enabled	Shows identification strings of ATAPI drives during boot process

19.6.1 Hard Disk x Submenu

Feature	Option	Description
Disk Type	None Custom **Auto-ID**	Custom - allows user input for cylinders, heads, sectors etc. Auto-ID - automatic detection of drive parameter
Enhanced Options	**LBA Mode** Multiple Sector Mode Fast PIO Mode	LBA - addressing mode with logical block numbers Multiple Sector Mode - defines block mode, i.e. generates a burst cycle PIO - force PIO mode ***Hint: Simultaneous settings are possible***
Cylinders	N/A	Number of cylinders
Heads	N/A	Number of heads
Sectors/Track	N/A	Number of sectors per track
Landing Zone	N/A	Defines the head park position
Write Precomp	N/A	Write precompensation cylinder number
LBA Range	N/A	Number of logical blocks
Size (MB)	N/A	Displays the calculated size of the drive

19.7 Components Menu

Feature	Option	Description
▸ CPU Speed	100 MHz **133 MHz**	Sets the CPU speed
Enable Standard PIT	**Disabled** Enabled	Sets standard PIT clock to 1.1932 MHz instead of 1.1882 MHz from SC520
▸ COM Ports	None **COM1, 3F8, IRQ4 (A)** **COM2, 2F8, IRQ3 (B)** COM3, 3E8, IRQ4 COM4, 2E8, IRQ3	Selects address and IRQ of serial port A and B
▸ LPT Port	None **LPT1, 378, IRQ7** LPT2, 278, IRQ5	Selects address and IRQ of parallel port
▸ LPT Type	**Standard AT** Bidirectional Enhanced Parallel	Sets the mode for the parallel port
Enable PS2-Mouse	**Disabled** Enabled	Enables or disables the PS/2 mouse support (including IRQ12)
Keyboard Numlock	Disabled **Enabled**	Enabled or Disabled turns NumLock on or off at boot-up
▸ Keyboard Repeat	Submenu	Defines keyboard parameter

19.7.1 Keyboard Repeat Submenu

Feature	Option	Description
Key Repeat Rate	2 cps, 6 cps, **10 cps** 15 cps, 20 cps, 30 cps	Sets the number of times to repeat a keystroke per second if you hold the key down
Key Delay	1/4 sec, **1/2 sec** 3/4 sec, 1 sec	Sets the delay time after the key is held down before it begins to repeat the keystroke

19.8 PCI/ISA Menu

Feature	Option	Description
▸ Configure PCI Ethernet ▸ Configure PCI VGA	Submenu	Defines IRQ and latency value for onboard PCI devices
▸ Configure DMA Channels	Submenu	Selects DMA channels corresponding with hardware settings
▸ Configure ISA Timing	**400 ns**, 800 ns 1.2 µs, 1.6 µs, 2.0 µs	Sets ISA base cycle time (I/O and memory access)

19.8.1 Configure PCI x Submenu

Feature	Option	Description
Select IRQ	**Auto**, Disabled IRQ5, IRQ9, IRQ10 IRQ11, IRQ15	Defines IRQ of onboard PCI device Auto - BIOS selects IRQ
Select Latency Value	**Auto**, Default 20, 40, 60, 80 100, 140, 180 220, 240, 255	Defines latency of onboard PCI device Auto - BIOS selects latency value

19.8.2 Configure DMA Channels Submenu

Feature	Option	Description
DMA A Channel	DMA0 (Memory) **DMA1** DMA2 (FDD) DMA3 (HDD)	Selects 8 Bit DMA channel for GPACK0/GPREQ0
DMA B Channel	**DMA5** DMA6 DMA7	Selects 16 Bit DMA channel for GPACK1/GPREQ1

19.9 Exit Menu

Feature	Option	Description
Save and Reboot	**OK** Cancel	Saves selections and exits setup. The next time the system boots, the BIOS configures the system according to the Setup selection stored in CMOS
Exit (No Save)	**OK** Cancel	Exits Setup without storing in CMOS any new selections you may have made. The selections previously in effect remain in effect
Factory Settings	**OK** Cancel	Sets default values for all Setup menus
Version Info	N/A	Shows version information

19.10 Kontron BIOS Extensions

Besides the INSYDE System BIOS, the PC/104-520 comes with a few BIOS extensions that support special features. All extensions are located in the onboard Flash. Some extensions are permanently available; some are active during boot-up.

Supported features include:

- JIDA standard (only JIDA16)
- Remote Control feature (special protocol, not JRC)

19.10.1 JIDA BIOS Extension

The JUMPtec Intelligent Device Architecture (JIDA) interface is integrated into the BIOS of the PC/104-520 module. This interface enables hardware-independent access to features that cannot be accessed via standard APIs.

The JIDA BIOS extension is not a true extension BIOS. It is part of the system BIOS and is located in the system BIOS segments after boot-up. It is permanently available and supports the JIDA 16-bit standard.

The JIDA 16-bit standard is a software interrupt 15h driven interface for programmers and offers lots of board information functions. For detailed information about programming, refer to the JIDA specification and a source code example (JIDAI???.ZIP), which you can find on the Kontron Website. The three question marks represent the revision number of the file. You also can contact technical support for this file.

19.10.2 Remote Control Client Extension

You can remotely control the PC/104-520 using software available from Kontron. This software tool can communicate with the board via one of the serial or the parallel port. During boot-up, the system BIOS scans the ports for an available connection. If detected, it starts the remote session.

The connection between the target system (PC/104-520) and the host (Desktop PC) occurs over the serial or parallel port via a special cable:

❶ Serial connection (DSUB-9)

Host (Pin)	Target (Pin)	Description Host
1	7, 8	/DCD
2	3	RXD
3	2	TXD
4	6	/DTR
5	5	GND
6	4	/DSR
7, 8	1	/RTS, /CTS

❷ Parallel connection (DSUB-25)

Host (Pin)	Target (Pin)	Description Host
2	15	PD0
3	13	PD1
4	12	PD2
5	10	PD3
6	11	PD4
10	5	/ACK
11	6	BUSY
12	4	PE
13	3	SLCT
15	2	/ERR
25	25	GND

The SC520Rmt program establish a remote connection. Syntax:

SC520Rmt [options]

/P:<port> port = COM1 - COM4 or LPT1 - LPT2 (host side)

-F disable host floppy drive

-K disable host keyboard

-V disable host graphic card

Example: SC520Rmt /P:COM1 -F

If the disable-option are used the redirection to the host hardware is disabled and the target hardware is used instead. To exit the program on the host press both SHIFT keys.

19.11 Updating the BIOS

Kontrons SC520Upd allows you to update the BIOS by using a floppy disk or harddisk without having to install a new ROM chip. Note that the supply voltage must not be removed during the chip programming or the module will not longer be bootable.

19.11.1 Flashing a BIOS

Use the following procedure to update the BIOS.

❶ Download the update program from the KONTRON Embedded Modules Website or contact your local technical support for it.

❷ Use SC520Upd with following arguments: SC520Upd [options] <filename>

/B	Reprogram the System BIOS. The file size must be 128 kB or 256 kB
/V	Reprogram the Video BIOS. The file size can be a maximum of 48 kB
/D	Clear CMOS values
/N	Do not reboot after programming
/R	Reads the BIOS and save it

Examples:

Write System BIOS:	SC520Upd /B /D PC104520.202
Read System BIOS	SC520Upd /B /R BIOS.BIN

Appendix A: System Resourcen

A.1 Interrupt Request Lines

Please note that Kontron PC/104 devices were designed after the draft of P996 Specification for ISA systems. Because of this, shareable interrupts are not supported. Some PC/104 add-on board manufacturers do not follow the P996 Specification and allow shareable interrupts. If you want to use such PC/104 boards with Kontron devices, contact the manufacturer of the add-on board and ask about switching to non-interrupt sharing. Please ensure that the chosen interrupt is not already in use by a PCI device.

IRQ #	Use	Available	Comment
0	Timer0	No	
1	Keyboard	No	
2	Cascade	No	
3	COM2 / COM4	No	*Note (1)*
4	COM1 / COM3	No	*Note (1)*
5	(LPT2)	Yes	*Note (1)*
6	Floppy	No	*Note (1)*
7	LPT1	No	*Note (1)*
8	RTC	No	
9		Yes	
10	PCI Device	No	Network controller *Note (2)*
11	PCI Device	No	Graphic controller *Note (2)*
12	(PS/2 Mouse)	Yes	*Note (1)*
13	FPU	No	
14	IDE0	No	*Note (1)*
15		Yes	

Note: *1 If the „used for" device is disabled in setup, the corresponding interrupt is available for other devices.*
2 You can change the default settings in the system's bios setup.

A.2 Direct Memory Access (DMA) Channels

DMA #	Used for	Available	Comment
0		Yes	
1		Yes	
2	Floppy	No	*Note (1)*
3		Yes	
4	Cascade	No	
5		Yes	
6		Yes	
7		Yes	

Note: *1 If the „used for" device is disabled in setup, the corresponding DMA channel is available for other devices.*

A.3 I/O Address Map

The I/O-port addresses of the processor module PC/104-520 are functionally identical to a standard PC/AT. All addresses not mentioned in this table should be available. We recommend that you do not use I/O addresses below 0110h with additional hardware for compatibility reasons, even if available.

I/O Address (h)	Use	Available	Comment
0000 - 001F	DMA Controller 1	No	Fixed
0010	System Control	No	Fixed
0020 - 003F	Interrupt Controller 1	No	Fixed
0040 - 005F	Timer, Counter	No	Fixed
0060 - 006F	Keyboard controller	No	Fixed
0070	NMI Enable Register	No	Fixed
0070 - 0077	Real Time Clock and CMOS Registers	No	Fixed
0080	BIOS POST	No	Fixed
0081 - 008F	DMA Page Register	No	Fixed
0092	System Control	No	Fixed
00A0 00BF	Interrupt Controller 2	No	Fixed
00C0 - 00DF	DMA Controller 2	No	Fixed
00E0 - 00EF	System Control	No	Fixed
00F0 - 00FF	Math Coprocessor	No	Fixed
01F0 - 01F7	Fixed Disk	No	Fixed
0278 - 027F		Yes	Free in standard configuration, but possible address of LPT2
02E8 - 02EF		Yes	Free in standard configuration, but possible address of COM4
02F8 - 02FF	Serial Port 2	No	Default for COM2, free with different configuration
0378 - 037F	Parallel Port 1	No	Default for LPT1; free with different configuration
03B0 - 03DF	VGA	No	Fixed
03E8 - 03EF		Yes	Free in standard configuration, but possible address of COM3
03F8 - 03FF	Serial Port 1	No	Default for COM1, free with different configuration
0A79	PnP Extension	No	Fixed
0400 - 0BFF		Yes	Free for user access

Note: *I/O-addresses above 0C00h are components of the PCI address space.*

A.4 Memory Map

The first 640 kB of DRAM are used as main memory. Using DOS, you can address 1 MB of memory directly. Memory area above 1 MB (high memory, extended memory) is accessed under DOS via special drivers such as HIMEM.SYS and EMM386.EXE, which are part of the operating system. Please refer to the operating system documentation or special textbooks for information about HIMEM.SYS and EMM386.EXE.

Other operating systems (Linux or Windows versions) allow you to address the full memory area directly.

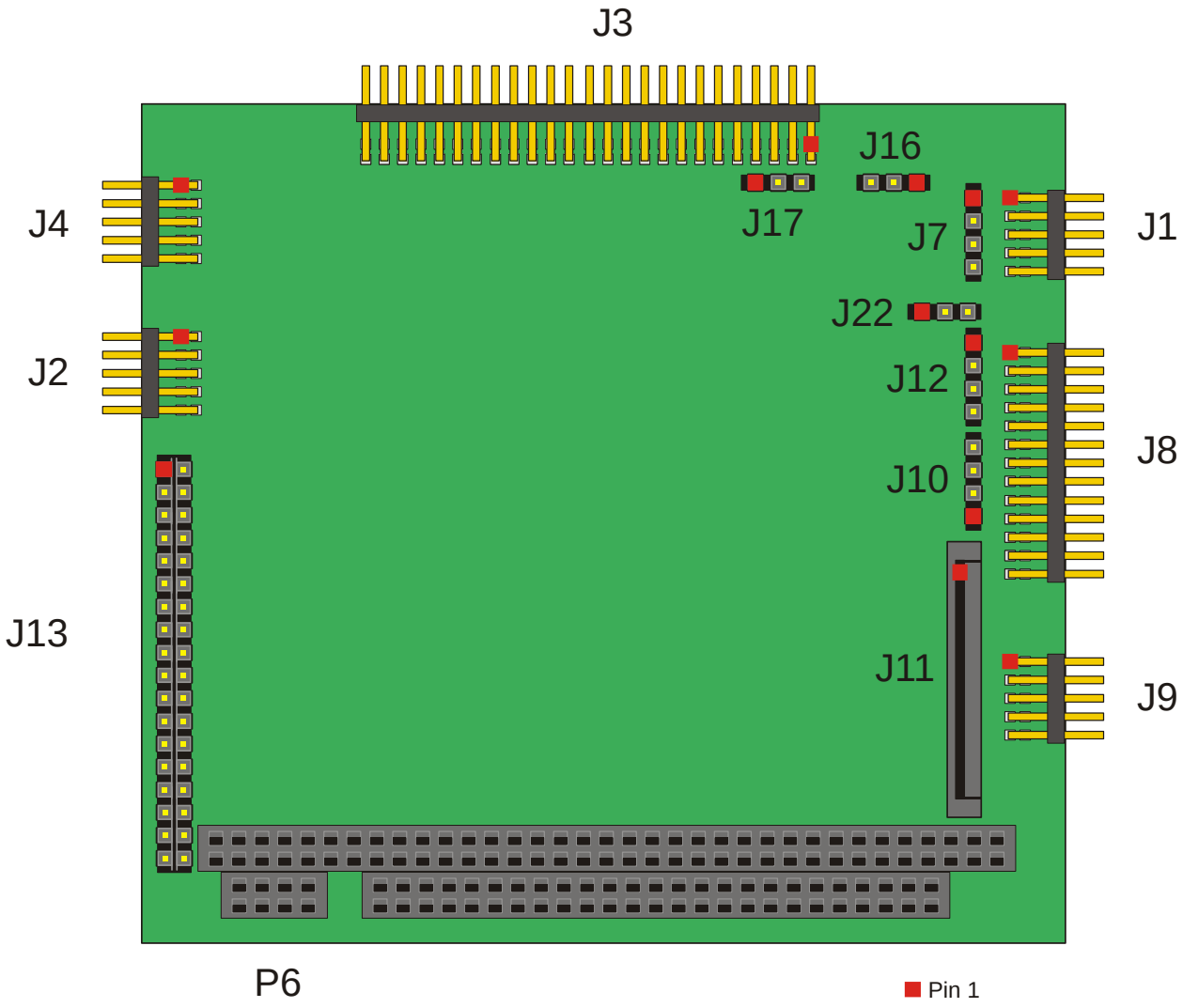
Upper Memory	Use	Available	Comment
A0000h – BFFFFh	VGA Memory	No	Mainly used by graphic adapter cards
C0000h – CBFFFh	VGA BIOS	No	Used by onboard VGA ROM
CC000h – E1FFFh		Yes	Free for ISA bus or shadow RAM in standard configurations
E2000h – FFFFFh	System BIOS	No	Fixed

A.5 PCI Devices

All devices follow the Peripheral Component Interconnect 2.1 or 2.2 (PCI 2.1/2.2) specification. The BIOS and OS control memory and I/O resources. Please see the PCI 2.1/2.2 specification for details.

PCI Device (IDSEL)	PCI IRQ	REQ / GNT	Comment
Onboard Host Bridge	None		Integrated in SC520
Onboard Graphic Controller	INTA	REQ0/GNT0	External LynxEM+ (SM712)
Onboard Network Controller	INTB	REQ1/GNT1	External i82551ER

Appendix B: Connector Layout



The Board as depicted is a model only, showing the positions of the connectors. For pincount and pinning please see the following tables.

B.1 Connector Functions & Interface Cables

The table notes connector functions, as well as mating connectors and available cables.

Connector	Function	Mating Connector	Available Cable	Description
P6	Power Connector	2.54mm 8 pos. (EPT 962-60043-12 or compatible for board to board connection)		
J4	CRT Monitor Connector	2.54mm 10 pos. (AMP 1-215882-0 or compatible)	KAB-PC104520-VGA (PN 96229-0200-00-0)	for DSUB-15 adaptation
J3	Flat-panel display Connector	2.54mm 50 pos. (W+P Products 947-14-050-00 or compatible)	KAB-????	Kontron cables
J1, J2	Serial Interfaces COM A and COM B Connectors	2.54mm 10 pos. (AMP 1-215882-0 or compatible)	KAB-DSUB9-2 (PN 96017-0000-00-0)	for DSUB-9 adaptation
J8	LPT Connector	2.54mm 26 pos. (AMP 2-215882-6 or comp.)	KAB-DSUB25-1 (PN 96015-0000-00-0)	for DSUB-25 adaptation
J10	PS/2 Mouse Connector	2.54mm 4 pos. (W+P Products 943-12-004-00 or compatible)	KAB-PC104520MOUSE-PS2 (PN 96230-0200-00-0)	for PS/2 mouse
J9	Keyboard and Feature Connector	2.54mm 10 pos. (AMP 1-215882-0 or compatible)	KAB-KB-1 (PN 96023-0000-00-0) or KAB-KB-PS2 (PN 96060-0000-00-0)	for AT-keyboard or PS/2 keyboard
J13	IDE Hard Disk Connector	2mm 44 pos. (Berg 89361-144 or compatible)	KAB-IDE-25 (PN 96020-0000-00-0) or KAB-IDE-2MM (PN 96021-0000-00-0)	for 3.5" HDD or 2.5" HDD
J11	Floppy Disk Connector	1.25mm 26 pos. (JST 26FMZ-BT or compatible)	ADA-FLOPPY-2 (PN 96001-0000-00-0) or KAB-FLOPPY/MOPS-1 (PN 96019-0000-00-0)	for Floppy adaptation
J7	Ethernet Interface Connector	2.54mm 4 pos. (W+P Products 943-12-004-00 or compatible)	KAB-PC104520-ETN (PN 96231-0200-00-0)	for RJ45 adaptation
J12	Infrared Connector	2.54mm 4 pos. (W+P Products 943-12-004-00 or compatible)		for special adaptation

B.2 Pinout Table

Pin	PC104 Bus (A)	PC104 Bus (B)	PC104 Bus (C)	PC104 Bus (D)
0			GND	GND
1	/IOCHCK (NMI)	GND	/SBHE	/MEMCS16
2	SD7	RESETDRV	LA23 *(3)*	/IOCS16
3	SD6	VCC *(2)*	LA22 *(3)*	IRQ10
4	SD5	IRQ9	LA21 *(3)*	IRQ11
5	SD4	-5V	LA20 *(3)*	IRQ12
6	SD3	DRQ2	LA19 *(3)*	IRQ15
7	SD2	-12V	LA18 *(3)*	NC
8	SD1	NC	LA17 *(3)*	/DACK0
9	SD0	+12V	/MEMR	DRQ0
10	IOCHRDY	GND *(1)*	/MEMW	/DACK5
11	AEN	/SMEMW	SD8	DRQ5
12	SA19	/SMEMR	SD9	/DACK6
13	SA18	/IOW	SD10	DRQ6
14	SA17	/IOR	SD11	/DACK7
15	SA16	/DACK3	SD12	DRQ7
16	SA15	DRQ3	SD13	VCC *(2)*
17	SA14	/DACK1	SD14	NC
18	SA13	DRQ1	SD15	GND
19	SA12	/REFRESH	GND	GND
20	SA11	SYSCLK		
21	SA10	IRQ7		
22	SA9	IRQ6		
23	SA8	IRQ5		
24	SA7	IRQ4		
25	SA6	IRQ3		
26	SA5	/DACK2		
27	SA4	T/C		
28	SA3	BALE		
29	SA2	VCC *(2)*		
30	SA1	OSC		
31	SA0	GND		
32	GND	GND		

Pin	IDE J13	Panel J3	LPT J8	Floppy J11	COM A J1	COM B J2
1	/RESET	DE	/STB	VCC *(2)*	/DCD1	/DCD2
2	GND	GND	/AFD	/IDX	/DSR1	/DSR2
3	HDD7	FLM	PD0	VCC *(2)*	RXD1	RXD2
4	HDD8	GND	/ERR	/DR0	/RTS1	/RTS2
5	HDD6	LP	PD1	VCC *(2)*	TXD1	TXD2
6	HDD9	GND	/INIT	/DSKCHG	/CTS1	/CTS2
7	HDD5	DE	PD2	VCC *(2)*	/DTR1	/DTR2
8	HDD10	GND	/SLIN	NC	/RI1	/RI2
9	HDD4	CLOCK	PD3	NC	GND	GND
10	HDD11	GND	GND	/MTR0	VCC *(2)*	VCC *(2)*
11	HDD3	FPEN	PD4	NC		
12	HDD12	GND	GND	/FDIR		
13	HDD2	FP6	PD5	NC		
14	HDD13	FP19	GND	/STEP		
15	HDD1	FP7	PD6	GND		
16	HDD14	FP20	GND	/WDATA		
17	HDD0	FP0	PD7	GND		
18	HDD15	FP21	GND	/WGATE		
19	GND	FP1	/ACK	GND		
20	KEY (NC)	PANEL VCC	GND	/TRK0		
21	DRQ	PANEL VCC	BUSY	GND		
22	GND	NC	GND	/WRTPRT		
23	/IOW	NC	PE	GND		
24	GND	CONTRAST+	GND	/RDATA		
25	/IOR	CONTRAST-	SLCT	GND		
26	GND	FP2	NC	/HDSEL		
27	IOCHRDY	GND				
28	CSEL	FP3				
29	/ACK	GND				
30	GND	FP4				
31	SIRQ	GND				
32	/IOCS16	FP5				
33	SA1	GND				
34	NC	FP14				
35	SA0	GND				
36	SA2	FP15				
37	/CS1	GND				
38	/CS3	FP8				
39	/DASP	GND				
40	GND	FP9				
41	VCC *(2)*	GND				
42	VCC *(2)*	FP10				
43	GND	FP18				
44	NC	FP11				
45		FP17				
46		FP12				
47		FP16				
48		FP13				
49		FP23				
50		FP22				

Pin	KBD J9	LAN J7	CRT J4	PS/2 Mouse J10	Infrared J12	Power P6
1	SPEAKER	TXD+	GND	MSDAT	VCC *(2)*	GND
2	GND	TXD-	GND	VCC *(2)*	IRTX	VCC *(2)*
3	/RESIN	RXD+	GND	GND	IRRX	BATT
4	/KBLOCK	RXD-	GND	MSCLK	GND	+12V
5	KBDAT		RED			NC
6	KBCLK		HSYNC			-12V
7	GND		GREEN			GND
8	VCC *(2)*		VSYNC			VCC *(2)*
9	BATT		BLUE			
10	/RESIN		NC			

Note:
1. *Key pin for PC/104; GND for PC/104+ specification.*
2. *To protect the external power lines of peripheral devices, make sure that*
   - *the wires have the right diameter to withstand the maximum available current.*
   - *the enclosure of the peripheral device fulfils the fire protecting conditions of IEC/EN 60950.*
3. *No delay to SA lines.*

Appendix C: Literature Hints

The following sources of information can help you better understand PC architecture.

C.1 General PC Architecture

- *Embedded PCs*, Markt&Technik GmbH, ISBN 3-8272-5314-4 (German)
- *Hardware Bible*, Winn L. Rosch, SAMS, 1997, 0-672-30954-8
- *Interfacing to the IBM Personal Computer*, Second Edition, Lewis C. Eggebrecht, SAMS, 1990, ISBN 0-672-22722-3
- *The Indispensable PC Hardware Book*, Hans-Peter Messmer, Addison-Wesley, 1994, ISBN 0-201-62424-9
- *The PC Handbook: For Engineers, Programmers, and Other Serious PC Users*, John P. Choisser and John O. Foster, Annabooks, 1997, ISBN 0-929392-36-1

C.2 Buses

C.2.1 ISA, Standard PS/2 - Connectors

- AT Bus Design: Eight and Sixteen-Bit ISA, E-ISA and EISA Design, Edward Solari, Annabooks, 1990, ISBN 0-929392-08-6
- AT IBM Technical Reference Vol 1&2, 1985
- *ISA & EISA Theory and Operation*, Edward Solari, Annabooks, 1992, ISBN 0929392159
- ISA Bus Specifications and Application Notes, Jan. 30, 1990, Intel
- *ISA System Architecture, Third Edition,* Tom Shanley and Don Anderson, Addison-Wesley Publishing Company, 1995, ISBN 0-201-40996-8
- *Personal Computer Bus Standard P996*, Draft D2.00, Jan. 18, 1990, IEEE Inc.
- Technical Reference Guide, Extended Industry Standard Architecture Expansion Bus, Compaq 1989

C.2.2 PCI/PC-104

- *Embedded PC 104 Consortium*. The consortium provides information about PC/104 and PC/104-Plus technology. You can search for information about the consortium on the Web
- *PCI SIG*. The PCI SIG provides a forum for its ~900 member companies, who develop PCI products based on the specifications that are created by the PCI SIG. You can search for information about the SIG on the Web
- *PCI & PCI-X Hardware and Software Architecture & Design*, Fifth Edition, Edward Solari and George Willse, Annabooks, 2001, ISBN 0-929392-63-9
- *PCI System Architecture,* Tom Shanley and Don Anderson, Addison-Wesley, 2000, ISBN 0-201-30974-2

C.3 Ports

C.3.1 RS-232 Serial

- *EIA-232-E standard*. The EIA-232-E standard specifies the interface between (for example) a modem and a computer so that they can exchange data. The computer can then send data to the modem, which then sends the data over a telephone line. The data that the modem receives from the telephone line can then be sent to the computer. You can search for information about the standard on the Web
- RS-232 Made Easy: Connecting Computers, Printers, Terminals, and Modems, Martin D. Seyer, Prentice Hall, 1991, ISBN 0-13-749854-3
- *National Semiconductor*. The Interface Data Book includes application notes. Type “232” as a search criteria to obtain a list of application notes. You can search for information about the data book on National Semiconductor’s Website

C.3.2 ATA

- *AT Attachment (ATA) Working Group*. This X3T10 standard defines an integrated bus inter- face between disk drives and host processors. It provides a common point of attachment for systems manufacturers and the system. You can search for information about the working group on the Web. We recommend you also search the Web for information on *4.2 I/O cable*, if you use hard disks in a DMA3 or PIO4 mode.

C.3.3 USB

- *USB Specification*. USB Implementers Forum, Inc. is a non-profit corporation founded by the group of companies that developed the Universal Serial Bus specification. The USB-IF was formed to provide a support organization and forum for the advancement

and adoption of Universal Serial Bus technology. You can search for information about the standard on the Web

C.4 Programming

- *C Programmer's Guide to Serial Communications*, Second Edition, Joe Campbell, SAMS, 1987, ISBN 0-672-22584-0
- *Programmer's Guide to the EGA, VGA, and Super VGA Cards*, Third Edition, Richard Ferraro, Addison-Wesley, 1990, ISBN 0-201-57025-4
- *The Programmer's PC Sourcebook,* Second Edition, Thom Hogan, Microsoft Press, 1991, ISBN 1-55615-321-X
- *Undocumented PC, A Programmer's Guide to I/O, CPUs, and Fixed Memory Areas*, Frank van Gilluwe, Second Edition, Addison-Wesley, 1997, ISBN 0-201-47950-8

APPENDIX D: REVISION HISTORY

Revision	Date	Edited by	Changes
1.0	07/24/2007	M. Hüttmann	First revision
1.1	11/30/2007	M. Hüttmann	Change min. operating temperature
1.2	12/05/2007	M. Hüttmann	Added battery safety instructions